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The gender effect on the evaluations of multimedia textbooks

Introduction

Both the boys and girls use educational software in schools, but they have different preferences about the characteristics and the content of educational software (Caftori, 1994; Joiner, 1998).

Previous studies (Kliman, 1999; Passig & Levin, 2000) have revealed that educational software is often designed for boys and not for girls. This kind of software does not motivate girls and it may explain why girls perform as well on educational software as boys. Therefore, a question arises which programs are preferred by boys and which ones by girls and which programs are easier to navigate by boys and which ones by girls.

This research focuses on the students' evaluations of manipulation and computerised assessment. These two fields were chosen because manipulation instead of turning the pages and computerised assessment are two of the most important differences between the traditional and multimedia textbooks.

Literature review

Different researches have studied the attitudes of boys and girls towards computers (McGrath & Thurston, 1992; Rattanapian & Gibbs, 1995; Teh & Fraser, 1995; Young, 2000). There are some studies about preferences about the educational software (Caftori, 1994; Kliman, 1999) and preferences about design of educational software (Joiner, 1998; Passig & Levin, 2000).

Some research found that boys have greater interest in computers than girls both at home and at school (Rattanapian & Gibbs, 1995). The other researchers have declared, that there were no significant gender differences in boys' and girls' attitudes towards computers (Teh & Fraser, 1995). Kay (1992) has claimed that there are fewer differences in computer attitudes and use among preschoolers and primary school students than older students. One piece of research (McGrath & Thurston, 1992) found out that girls like computers more than boys. Maybe one reason is educational software, which is not developed according to girls' needs and preferences.

Caftori (1994) investigated which educational software is preferred by boys and which by girls. She found out that boys choose more difficult programs than girls. Author considered the programs difficult, when a great deal of trivia had to be memorized. Also boys liked more aggressive programs. Kliman (1999) analysed the educational software. She asserted that many computer games are stereotypically for male audience. These programs are violent, aggressive, with primarily male characters, and focused on competition.

Joiner (1998) compared preferences of boys and girls in four educational programs: Pirates (all characters are men), Princess (all characters are women), Honeybeards (neutral by gender) and Blocksworld (abstract program). All these four programs were different versions about one of the educational program. It became evident that boys preferred the program named Pirates and girls preferred the program named Princess.

Passig and Levin (2000) have found that compared to girls, boys gave attention to navigational support. They wanted to know how to continue, how to go backwards, they preferred variety of choices. Girls paid attention to learning interface and dealing with colour and appearance.

Method

Fifty-four students (21 boys and 33 girls) from four schools in Estonia participated in the experiment. Their age was between 15 and 16. All the groups were of mixed ability.

Six multimedia textbooks were chosen for the study: mathematics, chemistry, geography, Estonian language and 2 textbooks of history. Six units of each textbook (except mathematics, in which 5 units were taken) were used in the experiment. These units of the multimedia textbooks were quite different in their structure and features.

The study took place during a period of over 8 months. All these 35 units of the multimedia textbooks were presented to the students. Students worked with computers independently with every unit. After learning each unit, we asked the students to evaluate the ease of the manipulation and fitness of assessment in a 10-point scale.

At the same time, we analysed the units of multimedia textbooks. Forty-six characteristics were about the multimedia textbook manipulation, such as number of menus, percentage of terms in menus and submenus, search capability, navigation

possibilities, number of commands, buttons and icons etc. Twenty-five characteristics specified questions and responses in the unit such as the modes of questions, replying, feedback and hints.

The values of the characteristics of each unit were found by using strictly fixed rules. Some of the characteristics were on alternative scales and expert opinions in a 5-point scale (-2 to +2) were used for evaluating the three characteristics of the manipulating and one characteristic of the assessment.

Results

The statistical package SPSS 11.5 for windows was used for data analysis. We calculated coefficients of Speraman rank correlation between the evaluations of boys and girls and the units' characteristics to find out the characteristics of multimedia textbooks, which make the manipulation simpler as for boys so for girls and assessment also more suitable for both sexes. The most important Spearman correlation coefficients are given in Table 1 and in Table 2. We used also ANOVA for comparing different programs and Mann-Whitney U-test for comparing boys and girls.

Table 1 Correlation coefficients between the evaluations of plainness of manipulating and the characteristics of program units.

Characteristic		Mean value	Standard deviation	Correlation with boys' evaluation	Correlation with girls' evaluation
No	Name				
109	Guidelines on the title page	.38	.49	.03	.52**
131	Number of the levels in the menus	.51	.51	-.22	-.41*
138	Number of key-combinations	6.17	3.19	-.05	-.42*
141	Percentage of terms in the words of sub-menus	44%	26%	-.30	-.42 *
143	Search capabilities	.34	.48	-.29	-.57**
148	Number of commands (icons, buttons, key-combinations etc)	22.29	12.82	-.08	-.36*
149	Percentage of familiar commands	56%	38%	.27	.42*
151	Percentage of familiar icons	64%	39%	.32	.40*
158	Percentage of hyperlinks with marking	59%	40%	.12	.53**
162	Number of possibilities for navigation	1.8	.68	-.29	-.49**

167	Attractiveness of the realization	.20	.60	-.32	-.37*
202	Percentage of screen area for text	58%	26%	.33	.37*
203	Percentage of screen area for information	67%	22%	.38*	.48**
215	Keys PgUp PgDn	.66	.49	.29	.57**
319	Responding in the assessment with keyboard	.39	.50	.03	.41*
322	Guidelines for responding in the assessment	.57	.50	.23	.55**
325	Maximal number of the keystrokes for responding in the assessment	26.86	43.61	.33	.61**

* Statistically significant at the 0.05 level ** Statistically significant at the 0.01 level.

In the bold are given the correlation coefficients of boys' and girls' evaluations, which are different from each other at the 0.05 level.

Table 2 Correlation coefficients between the evaluations of fitness of assessment and the characteristics of program units.

Characteristic		Mean value	Standard deviation	Correlation with boys' evaluation	Correlation with girls' evaluation
No	Name				
300	Questions about solely unit in the assessment	.36	.49	.51**	.39*
318	Essential questions in the assessment	.76	.43	.60**	.56**
319	Responding in the assessment with keyboard	.39	.50	.17	.48**
322	Guidelines for responding in the assessment	.57	.50	.19	.47*
325	Maximal number of the keystrokes for responding in the assessment	26.86	43.61	.03	.55**
338	Announcement of the percentage of right answers	.57	.50	.21	.65**
340	Announcement of the responding time	.36	.49	-.39*	.06
342	New trial after the wrong answer in the assessment	.27	.46	.79	.30
346	Commendation after the right answer in the assessment	.27	.46	.79	.30

* Statistically significant at the 0.05 level ** Statistically significant at the 0.01 level.

In the bold are given the correlation coefficients of boys' and girls' evaluations, which are different from each other at the 0.05 level.

Discussion

The girls' evaluations of **the plainness of the manipulating** were correlated with the 17 characteristics of the manipulation of the program. The boys' evaluations of the plainness of the manipulation however were correlated only with the one characteristic. The reason for that result would be the fact that boys in our study had significantly higher computer skills and less computer anxiety than girls before the experiment (Mann-Whitney U-test $p < .05$) according to the questionnaires. The higher computer skills and lesser anxiety of boys ensure that boys can handle different programs' manipulation.

We found that the girls preferred more guidelines for the manipulation of the program. Units of the multimedia textbooks which had guidelines how to continue on the title page, how to input answers in assessment, were rated more highly by the girls.

Also, the girls preferred simpler program interface. A smaller number of key-combinations helps to reduce the navigational difficulty. Key-combinations are more difficult to remember than different buttons and icons. Also, the number of navigation possibilities and number of commands (icons, buttons, key-combinations etc) were negatively correlated with the girls' evaluations. If students can navigate with a mouse, with keys, with buttons and with menus, it is deceptive for learners and they do not know how to manipulate the program. Also Alessi and Trollip (2001, 173) recommend avoiding a greater number of navigation' possibilities. Our research showed that the girls preferred the familiar icons and commands. We considered the commands and the buttons in the units which were the same as in MS Office programs and Internet Explorer as the familiar ones. The latter programs are taught in Estonian schools. Higher computer skills and lesser anxiety of boys ensured that boys could handle the more difficult program manipulation and were able to navigate the program even when they did not know exactly what the command or icon meant. Boling *et al.* (1998) wrote that novice users should interpret more icons than experienced users, who recognize familiar buttons quickly and easily. Amber (2000) recommended taking over standards from IBM and Microsoft. Users are used to these buttons and icons and these corporations have defined about 95-99% icons, buttons, menus etc, which are needed in the user's interface.

The better computer skills of boys insure also that they do not get lost in the multimedia materials. The girls in our experiment needed more help for orientation.

They preferred less numbers of the levels in the menus and hyperlinks with marking, but the search capability and terms in the words of sub-menus were not preferred by the girls. All these four characteristics are connected somehow with the orientation. Levels in the hierarchical menus hinder the information and less experienced user do not find the necessary material. Alessi and Trollip (2001) recommend keeping the levels of the hierarchical menus few in number. Also the terms in the sub-menus hinder the information. When the user does not know the meaning of the choice in the menus or in the sub-menu he/she does not choose it. Hyperlinks with marking mean that hyperlink change colour if once selected. This kind of feature prevents going in circles when the user is lost in hyperspace. Search capability is useful when the information seeking is needed, but when the goal is obtaining the textual material, inexperienced users may get lost, because they do not know how they got to the concrete page and how they can go back.

An interesting result was that the girls' evaluations of the plainness of the manipulation of the program unit were negatively correlated with the attractiveness of realization, evaluated by the experts. The reason for that result might be again the fact that the girls in our study had less computer experiences. Mayer and Moreno (2002) and Najjar (2001) point out that effects of the multimedia presentation have more influence on the inexperienced users and lead their attention away from the learning goal. Therefore the great attractiveness of the realization might lead the girls' attention away from the manipulation too.

Manipulation was simpler for the girls with the keys. The girls preferred to navigate in the material with the keys *Page Up* and *Page Down* and they preferred also to input answers in the assessment with the keyboard. Also, the maximal number of keystrokes for responding in the assessment positively related to the girls' evaluations of the plainness of the manipulation.

The percentage of the screen area for text and the percentage of the screen area for the information are not exactly the manipulation characters but they have an influence on navigation. When the program window covers only a half area of the screen, all the other programs' icons and the office toolbar are still visible and may distract attention. Also the inexperienced user may unintentionally click on other icons and he/she gets frustrated when another program opens. Therefore the percentage of the screen area for the information was positively correlated with both

the boys' and girls' evaluations of the manipulation. The percentage of the screen area for the text was positively correlated with the girls' evaluations.

But there was not any evidence that concrete structure of the unit (linear, hierarchical or unstructured) is easier to navigate for the boys than for the girls (with ANOVA $p > .05$).

About the **fitness of the assessment** as boys, so girls need the questions to be about single unit, which they have just studied and questions had to be essential. Replying is simpler for the girls' with the keys. Responding with the keyboard in the assessment and maximal number of keystrokes for responding were positively correlated with the girls' evaluations of the fitness of assessment. And as we have repeatedly mentioned the girls in our study had less computer skills, so they needed guidelines for assessment.

There were statistically significant differences in students' evaluations of the fitness of assessment by the features of assessment (with ANOVA $p < .01$). Tukey's HSD indicated that the boys' evaluations were significantly higher if the assessment was a part of the unit ($p < .001$). It became evident from the girls' evaluations that their evaluations for assessment as a part of the unit were significantly higher than for assessment without feedback. The reason for that result might be that the girls need more feedback than boys as was suggested by Chanlin (1999).

The most important differences were found in the boys' and girls' evaluations about the feedback. The boys preferred new trial when the answer was wrong, and feedback after the right answer with commendation. Announcement of the responding time was negatively correlated with the boys' evaluations. The girls preferred feedback, which could inform them about the percentage of right answers.

Conclusion

The lists of preferred characteristics were different for girls and boys. The girls need simpler manipulation of the programs than boys do. To design educational software which motivates girls, the complicity of navigation and guidelines for orientation must be carefully controlled. As the assessment is evaluated more highly if it is a part of a learning unit, it is more rational not to program the assessment as a separate module or piece of software. When designing the assessment, preferences of feedback both boys and girls should be taken into consideration.

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